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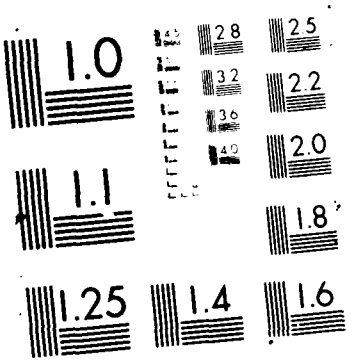
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ONRL Report 7-026-C

Highlights of the 70th Flight Mechanics Panel Symposium on Flight Vehicle Development Time and Cost Reduction

Dennis R. Sadowski

1 September 1987

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Selected presentations given at this meeting, held in May 1987 in Toulouse, France, are reviewed. Topics of the papers include cost estimating, use of CAE-CAD-CAM, prototype manufacturing, and computer-integrated manufacturing.

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HIGHLIGHTS OF THE 70TH FLIGHT MECHANICS PANEL SYMPOSIUM ON FLIGHT VEHICLE DEVELOPMENT TIME AND COST REDUCTION

1 INTRODUCTION

The NATO Advisory Group for Aerospace Research and Development (AGARD) held the subject symposium in Toulouse, France from 11 through 14 May 1987. Approximately 175 attendees representing defense agencies, universities, and industries of most of the NATO nations were present for the 27 formal briefings comprising the 4-day program.

The objective of the symposium was to provide a forum for identifying and discussing the elements that contribute to increased flight vehicles development time and cost and to explore ideas to arrest or reverse this growth. The perception is that time and, especially, the cost of new systems are increasing at an ever-accelerating rate that is greater than the rate of improvement of the capabilities of the flight vehicles. Even more important is the limiting application of technology to fewer affordable developments. The emphasis of the symposium was focused on the technical aspects of the problem.

The keynote address by Dr. J. Gansler, Vice President of The Analytic Sciences Corporation (TASC) and former US Assistant Secretary of Defense examined the importance of upfront planning to system definition and specification. Most life costs are committed at this critical stage. Interestingly, although defense acquisition costs need to be contained and methods improved, the growth has been about average when compared to acquisition cost growth in other major industries.

No "earth shattering new tonic" was presented during the symposium to satisfy the objective. However, many of the speakers gave practical experience as to how their respective organizations were achieving success utilizing recent technology advances. The continued infusion of computer-aided activities, including robotics in the development process, shows promise for additional improvements in the efficiency and effectiveness of full-scale development programs. To date, most computer-aided efforts are largely "islands of advanced technology" which generally have not been fully integrated into the production effort to reduce the critical path time and costs. Error reduction and the use of prototypes and demonstration/validation programs continue to reduce risk, time, and cost.

2 PAPERS OF INTEREST

The English-language papers summarized below were some of the more interesting presentations at the symposium, and are available on request.

Picking Winners: Parametric Cost-Estimating and Project Management, P.G. Pugh, Ministry of Defence, UK. This paper proposes that there is a form of cost estimating which can be used from the very inception of a project and which brings large returns from a modest effort. Traditional methods assist attempts to control the costs of an ongoing project towards some preset target. The methods described here are directed more at the initial selection of projects and the setting of feasible cost targets for them. In brief, their role is to pick winners from the range of competing alternatives which present themselves before a major project is begun. At the least, these methods give greater assurance that the chosen solution will be viable in terms of its being attempted within realistic cost constraints.

The Increased Time and Cost of Development: Causes and (Some) Remedies, J.T. Gallagher, Northrop Corporation, US. This paper contains a discussion of the increased time and cost of development required for air vehicles. Concurrently, methods of reducing time and cost are examined. The evolution of air vehicle development is presented to provide the background surrounding technological advances. The increased time and cost associated with those advances are discussed in relation to methods of gaining time and cost reductions. In the last 40 years, new military fighter aircraft have grown increasingly more sophisticated in

response to new or anticipated enemy threats. Growth in aircraft capability has coincided with advancements in technologies, including propulsion, aerodynamic design, control systems, structural materials, and avionics. The greater complexity in the aircraft involved in full-scale engineering programs has complicated the design analysis and test processes. A full-scale development, as a precursor to production, must not only evolve a design which meets the defined performance requirements, but one which is capable of being produced at acceptable cost using established production processes.

Development Cost Reduction Using Integrated CAE-CAD-CAM Techniques, D. Falce, Aeritalia, Italy. The conventional process of a new aircraft design and development is based on sequential analysis and test cycles. Using an integrated CAE-CAD-CAM technique it is possible to increase the depth of the different configurations analysis, to reduce the cycle time and even the number of cycles required, and to achieve optimized design, thereby improving the product and reducing development costs and time. The CAD total data base integrated with analysis and manufacturing permits direct data transfer from engineering to manufacturing (CAM) and in addition makes faster and cheaper the embodiment of modifications during the development phase.

[illegible] Acquisition Trends and Future Approaches, R. Longbrake, US Air Force, US. The purpose of this paper is to document and investigate the methods of avionics acquisition, past characteristics, and trends to better understand the reasons for cost growths and increased schedules. In addition, future approaches are investigated to determine their impact on cost and schedules. Finally, some required technologies and future approaches to control avionics cost and schedules is presented.

[illegible] Manufacturing Technology for [illegible], Cost, Schedule, and Technical [illegible], J. Williams and M. Schuessler, Boeing Airplane Company, Seattle. The approach to develop necessary to develop a plausible prototype hardware manufacturing concept requires diligent efforts by all involved personnel. This text has addressed the philosophy employed by a leader in the aerospace industry, Boeing Airplane Company.

Structural Materials--The Changing Scene, R. Haresceugh, British Aerospace, UK. Structural materials for use on aircraft have, in the main, evolved by minor development from a previously existing base. These developments, which have been by small increments, have been fairly leisurely in the timescales involved. The major exception to this in the last two decades has been the introduction of fibrous composites which, while achieving a revolutionary change, has been effected against a protracted timescale. Developments are currently underway, or are being anticipated, which will require other revolutionary materials to be introduced but to much tighter timescales and against aircraft project requirements. The paper identifies examples where this development should be directed and proposes action necessary to ensure that the materials are developed to a common requirement in the required timescale.

Use of Demonstration/Validation Prototypes: Impact on Total Development Costs and Times, A. Notari, Aermacchi S.p.A., Italy. The results obtained by use of the demonstration/validation prototypes have been, in some instances, the subject of thorough analyses which have confirmed the validity and convenience of these prototypes to the end of reducing the overall time span of the acquisition cycle and its costs, especially when the development was marked by significant technological advances. In this paper, an attempt has been made to identify the conditions that should determine the convenience and success of a predevelopment program, and these are reexamined in terms of the advantages and disadvantages that such a program may entail in the present market situation and in a European industrial context.

Engineering Management for Validation Prototype Phase, A. Neviani, Aermacchi S.p.A., Italy. The success and

effectiveness of a concept demonstration-validation through the use of prototypes depend essentially upon the contractor's engineering management activities that should therefore be carefully tailored to the goals of the program. To this end, a special importance is borne by the activities for the definition of the most cost-effective prototype configuration; of planning, coordination and integration of the different specialty areas; and of reduction and simplification of the formal qualification documentation and decisional processes. These requirements mean that the customer must shape the contract layout to flexibility criteria and that the contractor adapt its organization by establishing an efficient task force led by a dedicated system engineering structure.

The Influence of Infrastructure on Costs and Time Scales of Collaborative Programs, R.M. Garrett, Ministry of Defence, UK. International collaboration is an increasingly important method of launching major new aircraft projects. In the military context there are substantial political advantages and also military benefits--not least as a consequence of interoperability--but the effect on costs is often a major consideration when deciding to pursue a collaborative rather than national project. The most obvious attraction is the sharing of development (and other nonrecurring) costs, particularly as these occur in the near-term future where budget pressures are often highest; moreover, the greater production volume should also lead to reductions in unit price. However, experience with collaborative aircraft programs to date suggests that there are also some more subtle effects operating which affect total program costs and thus change the financial and operational benefits to any single nation.

Time and Cost Reduction Through Computer Integrated Manufacture, Dr. J.B. Cox, British Aerospace, UK. Cox's paper sets out to review the reasons why CAD/CAM, since its introduction about 10 years ago, has provided only a limited increase in productivity and has had very little effect on the timespan from initiation of design to delivery of the first unit from production. Further productivity benefits and a reduction in the time taken to produce the first prototype can only be achieved by a more flexible approach to design and manufacture. This in turn puts a greater strain on the company's support system and a much greater integration of all the company's activities is required. Computer systems are a necessary means of producing the level of integration through information technology. This requirement is moving us from CAD/CAM to computer-integrated manufacture (CIM). The paper concludes by a review of the steps being taken within British Aerospace towards reducing project lead times and costs.

3 REPRINTS

For reprints of the above papers, contact CDR Dennis Sadowski, USN, Aerospace Systems Officer at ONR London, Box 39, FPO, NY 09510.

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